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| Pre-algebra Mastery |
| Mobilizing a Professional Learning Community to Close the Gap |
| Anthony Francisco |

American global competitiveness, workforce preparation, and development of an educated citizenry continue to fuel efforts to improve student performance in those areas (NSF National Science Board, 2006). Across the United States, states, schools, and students are now fully immersed in efforts to meet the educational accountability requirements set forth by the federal No Child Left Behind Act of 2001 (NCLB) (NCLB, 2002). NCLB requires the development of student performance standards and regular assessment of student learning (NCLB, 2002). Schools that fail to show progress in improving achievement for all students receive assistance first, and then may be subject to sanctions (NSF National Science Board, 2006, p. 8; NCLB, 2002). The recipient of a multi-year award under the Elementary and Secondary Education Act of 1965 shall continue to receive funds in accordance with the terms of that award, except that no additional funds may be awarded after September 30, 2002 (NCLB, 2002, p. 2). Local revenue has reduced while federal funding has increased to 12 percent (Providence School District, 2009). If the federal government were to award federal funds contingent upon proficient state scores and enforce sanctions, valuable programs and initiatives would be in jeopardy; these federal funds are used to train teachers and staff, engage parents and community, develop and implement a standards-based curriculum and curriculum frameworks, provide supplemental educational services, such as literacy clinics, additional assistance in elementary school classrooms, and after-school programs (Providence School District, 2009).

There is substantial underachievement in Rhode Island middle level schools and high schools as measured by the challenging academic standards that the state has adopted (Rhode Island Board of Regents, 2008). A lack of adequate academic skills in mathematics, with many students achieving below grade level, makes access to and success in middle level and high school curricula aligned to Rhode Island’s challenging academic standards extremely difficult for many students (Rhode Island Board of Regents, 2008). There is a decline in state assessment results for students as they progress from elementary through high school, and in particular, during the middle level period (Rhode Island Board of Regents, 2008). There is a wide disparity among Rhode Island high schools in terms of the preparation that students receive for further learning, the world of work, and service to their local community and state (Rhode Island Board of Regents, 2008). Students who take less academic rigorous courses are less likely to attain a college degree and do not do as well in the workforce as students who take more academically rigorous courses (National Center for Educational Statistics, 2003). There is compelling evidence that challenging coursework in high school leads to higher levels of academic achievement, success in college, and through this a greater range of opportunities in life (McPartland, Alta, & Balfanz, 2002).

Most high school students in Providence are not proficient in math (Rhode Island Department of Education, 2008). This is not exclusively a district problem; an overwhelming majority of adolescents in Rhode Island are not proficient in math (Rhode Island Department of Education, 2008). Seventy-three percent of 11th graders were deemed missing the mark (Rhode Island Department of Education, 2008). In Providence, only 28 percent of eighth graders were proficient- a mere 15 percent achieved a level of proficiency on the state test NECAP (Rhode Island Department of Education, 2008).

The international performance of America’s youngsters remains consistently mediocre (Committee for Economic Development, 2003). Though fourth graders perform well in both math and science in international comparisons, American twelfth graders finish towards, or at, the bottom of, these surveys (Committee for Economic Development, 2003). Globally, at grade eight, the average U.S. mathematics score was higher than those in 37 of the 47 other countries, lower than those in 5 countries (all of them located in Asia), and not measurably different from the average scores in the other 5 countries (National Center for Educational Statistics, 2008, p. 6). Nationally, only 23 percent of high school seniors performed at or above *Proficiency* (Grigg, Donahue, & Dion, 2005, p. 15).

Improving the math and science skills of our young people is an important step towards maintaining innovation-led economic growth in the coming decades (Committee for Economic Development, 2003). Youth who fail to access or succeed in algebra are likely to fail to get an education beyond that of high school and may be unqualified for many well-paying jobs (Kortering, de Bettencourt, & Brazil, 2005).

Several studies have chronicled the correlation between students’ prior achievement, the timing of mathematics course-taking, and performance on state standardized tests (Spielhagen, 2006). Students who were studying pre-algebra performed better on the National Assessment of Educational Progress (NAEP) (2000) state test than students taking the non algebraic eighth-grade math (Spielhagen, 2006). Statistics as to the algebraic readiness of the freshman year of high school students are not available, however NECAP scores reveal 59 percent of the Providence School District’s eighth graders were not proficient in pre-algebraic material(Rhode Island Department of Education, 2008)**.** What is the most cost effective and time efficient measure to close the achievement gap (all students on grade level) of high school freshman not proficient in pre-algebra skills without delaying the progress of those students who are proficient?

This paper focuses on the most effective measures to bring all ninth and tenth grade students to proficient levels in pre-algebraic material without hindering the progress of on-level students by mobilizing the educators in the building to this common vision lead by the Providence School District. Little systematic research has been conducted on the types of mathematical skills and strategies students who enter high school behind grade level lack (Spielhagen, 2006).

Ninth grade students are deemed not proficient in math, specifically in pre-algebraic skills, if they are unable to attain a score of 3 or 4 on the eighth grade NECAP state tests (Rhode Island Department of Education, 2008). Challenging academic standards that the state has adopted has revealed underachievement of Rhode Island middle and high school students (Rhode Island Board of Regents, 2008). A lack of adequate academic skills in mathematics, with many students achieving below grade level, makes access to and success in middle level and high school curricula aligned to Rhode Island’s challenging academic standards extremely difficult for many students (Rhode Island Board of Regents, 2008). Rhode Island math standards for 9th graders are defined by RIDE’s “Grade Span Expectations” (Rhode Island Department of Education, 2007).

Students who attend high-poverty high schools typically perform significantly below national norms and dramatically short of the performance benchmarks increasingly used to measure academic success (Balfanz, Legters, & Jordan, 2004). The achievement gap in this context consists of Providence’s Black and Latino students who are two times more likely to have below basic skills in pre-algebra than white students (Rhode Island Department of Education, 2008). This gap also includes the fact that economically challenged students scored lower than their middle class counterparts (National Center for Educational Statistics, 2007).

The research illustrates measures educators can adopt to raise the proficiency levels of ninth graders in pre-algebra in preparation for state tests. Balfatz et. al stress that “the primary need is not remediation in the most basic elementary level skills, but rather organized learning opportunities to accelerate students’ acquisition of intermediate level skills (e.g. fluency and vocabulary in reading and operating with rational numbers and integers in mathematics) and more advanced reading comprehension and mathematical reasoning strategies” (McPartland, Alta, & Balfanz, 2002). We need to “re-conceptualize” what extra help implies (McPartland, Alta, & Balfanz, 2002). Spielhagen’s study suggests offering more pre-algebraic math courses before ninth grade, that is, algebra in eighth grade (Spielhagen, 2006). This could be achieved through a “transition math” program that facilitates the transition from eighth to ninth grade effectively and be utilized to close the achievement gap (Neild, Stoner-Eby, & Furstenburg, 2008) in the form of a summer math institute or “Math Corps Summer Camp” (Eduards, Khan, & Brenton, 2001). A ninth grade success academy, nationally known as the Talent Development High School (TDHS), could dedicate a section of the school to freshman and provides a double dose of provisional accelerated math to afford every student an opportunity to reach pre-algebra proficiency by the end of first semester (Balfanz, Legters, & Jordan, 2004).

Teachers and principals are responsible to enhance and measure student learning within their classrooms/schools; they are also responsible to prepare and motivate students for high-stakes testing (Supon, 2008). However, not much research exists as to the rate student learning can be accelerated to close the pre-algebra to algebra-ready gap in ninth grade (Balfanz, Legters, & Jordan, 2004). The researcher has elected to face this problem by not focusing on the reasons for ill prepared freshman in math by declining to pass judgment, question, or blame on the students’ previous ill prepared experience in math preparation, but seeks to deal with the problem at face value and find a solution through the perspective of a high school principal. It is the our hope that closing the pre-algebra achievement gap this will lead to a higher graduation rate, lower drop-out rate, a better prepared workforce, higher college acceptance rates, and acceptable levels of proficiency on state scores.

Two concordant programs could work to decrease the amount of students requiring pre-algebra intervention: an intense and time constrained intervention by means of a nontraditional schedule that focuses on depth and specificity of particular problem structures, and one imbedded as a yearlong course during the traditional school day. The latter will be the first item to discuss since it seems more feasible due to resource and economical viability.

Mobilizing educators in the building toward the common goal to bring all students to pre-algebraic mastery will involve coordinated and deliberate measures. Both approaches involve multiple objectives in addition to eliminating the mathematics achievement gap at each engagement. The goals are twofold and layered throughout each team meeting: to eliminate the pre-algebra to algebra gap and to ensure that academic press, while guaranteeing academic rigor at our school. Each teacher leader will understand two overarching goals: to increase proficiency in numeracy and literacy across disciplines. Each teacher leader will be a participant in the Instructional Leadership Team (ILT) meetings by sharing best practices in academic press in these areas. For this paper, we spotlight the role of the teacher leader of mathematics. It is also noteworthy to mention that in addition to the math teacher leader, all teacher leaders are required to perform the same participatory tasks in our meetings. In essence, each is being trained to effectively lead others. The vehicles that will sustain and move our educators to carry the agenda will be via the formation of teams, not committees nor groups.

School-wide initiatives, such as measuring, monitoring, and encouraging pre-algebraic mastery, require a gradual and deliberate plan of introduction in order to gain the confidence of the majority of teachers. The main vehicle to promote the pre-algebraic mastery initiative will ideally be through my (ILT) (Southern Regional Education Board, 2009). This goal could take up to three to four years to achieve successful fruition before gaining the confidence of staff and students and accomplishing a normative practice status. Year one would focus solely on training the ILT to measure, monitor, and encourage pre-algebraic mastery and press. Year two would focus exclusively on introducing a taxonomy table and the skill of measuring pre-algebraic mastery to the faculty at large by means of a knowledgeable expert. Year three would involve a continued training involving the practice of measuring and monitoring. And lastly, the fourth year would include full implementation of measurement, monitoring, and the calculated focus of engaging the teachers in the practice of encouraging or ensuring students achieve mastery in both basic mathematics and in their the other respective disciplines.

The ILT’s training during the first year would involve my direct instruction in the role of principal qua professor. The ILT could meet on a weekly basis; therefore one meeting a month would be dedicated to training this elite team of academic leaders. The first and second month, September and October, we would define what pre-algebraic mastery is using the standards to measure it, and discuss its relevance to our work. The third month’s meeting would focus on measuring pre-algebraic proficiency at the classroom level, and the fourth meeting in December would focus on measuring pre-algebraic proficiency at the school level.

The first half of the first year of training would involve an introduction to the concept of mastery. Our first meeting in September would entail a jigsaw exercise among the twelve teacher leaders utilizing three reading packets related to high expectations, pre-algebraic proficiency, and college and work readiness (Common Core State Mathematics Standards for College and Work, 09). We would then examine sample artifacts for evidence of pre-algebraic proficiency, high expectations and effort using a chart in each small group and then report out. The second meeting in October would include an introduction to the taxonomy table – an academic rigor tool that ensures alignment of math standards, objectives, and problems (Southern Regional Education Board, 2009) - and the Depth of Knowledge chart (Webb, 06). A practice table, which includes prepared sample standards, would be used to practice navigating the taxonomy table. The third meeting, dedicated to pre-algebraic proficiency in November, would involve a quick examination of sample unit to guide the ILT’s understanding of the concept of mathematics alignment as it relates to the NECAP, the state math standards, and the Providence School Department pacing guides by using an academic taxonomy table. In December’s meeting, the ILT would continue to practice using the taxonomy table by examining a sample unit and table. Groups would determine the correct cell on the taxonomy table for elements in the sample unit.

After winter recess, in January, I would engage the ILT to discuss practices that increase pre-algebraic proficiency at the classroom level. Unit planning, explaining expectations and making assignments, providing feedback, and working toward mastery for all students would be the focus of discussion. Thereafter, members of the ILT would map out their view of what our school’s plan to examine pre-algebraic proficiency at the classroom level should look like. The sixth meeting in February would be dedicated to peer review of their own sample units. I would be first to model the exercise by using my own unit from my teaching years in the classroom. Groups would utilize the taxonomy table and a materials table to determine the correct cell in the table.

The rest of the year would be focused on training the ILT in using protocols to look at teacher work and improve pre-algebraic proficiency in the classroom. In March, our seventh meeting dedicated to pre-algebraic mastery training, would involve sharing and extending the work. Each group would present their feedback to the group that brought the unit, repeat by trading places, and the share out by preparing a summary of key learning points. April’s meeting would require the practice of the tuning protocol. Most of the faculty is familiar with and has engaged in the tuning protocol developed by educators associated with the National School Reform Faculty (Harmony Educatioin Center, 06). May and June are characterized by intense activities of all kinds in preparation for events, such as graduation; therefore prudence would be taken to plan accordingly. May’s meeting with the ILT would include an introduction and examination of a taxonomy table rubric inspired by Cheryl Gray, Pat Mohr, and Andrea Keim to ensure pre-algebraic proficiency and college readiness (Southern Regional Education Board, 2009). The goal would be to complete a self-assessment of Hope’s school-wide practices, choose priority areas for dashboard gauges, identify goals and strategies for improvement, and engage the ILT to construct their own dashboard gauge for our school.

Year two and beyond are simulations of the ILT’s training, but piecemealed into smaller increments. Essentially, the same process that the ILT took to learn to measure, monitor, and encourage pre-algebraic mastery during the prior year is transferred to the departmental/team meetings. The second year would be characterized as the school’s introduction to measuring pre-algebraic mastery through Hope’s ILT. This practice takes place every month for nine months. Year three involves the ILT in facilitating each department meeting and continuing to engage their faculty in measuring and monitoring exercises in order to become accustomed to the goals and each other. Each meeting is recorded and discussed during one ILT meeting a month to identify common problems and solutions thus far with the faculty. Year four is characterized by full implementation of measuring, monitoring, and encouraging pre-algebraic mastery and academic press by requiring faculty to devise action plans for their own units. At this juncture, all faculty is engaged in the art of continual student work examination by use of the tuning protocol and goal setting.

Instructional strategies that teachers use to foster higher levels of learning in their students and to increase pre-algebraic proficiency in their classrooms must include an array of questioning techniques to prompt low, mid and higher level cognitive processing for all students. Common grading criteria have to be collaboratively established by teachers of all subject areas, grades, or courses. The school’s staff must reach consensus on what constitutes proficiency on grade-level standards with little variation among teachers’ expectations, rubrics and grading. Units should reveal the need for students to evaluate their knowledge. Assignments must include student evaluations of their own and peers’ work that match teacher or rubric definitions for quality.

In order to gain the confidence of my staff, my role of principal qua professor is indispensable in establishing clear expectations. Meanwhile, the formation of our Instructional Leadership Team (ILT) ideally would have already been assembled before the start of the school year. The ILT would consist of a teacher leader from each discipline in the school and one teacher leader supervisor to coordinate the meetings and agendas for me. Once my whole school faculty has learned of my expectations on effective teaming, then theory will translate to practice by requiring each member to join at least one of several teams. I will introduce the team name and its purpose in order to aid prospective members to join with enthusiasm. One of those teams will be the math intervention team (MIT). In order to maximize the potential of this MIT, as with all of the teams, anyone is free to join the team of his/her choice with the understanding that our expectations require genuine commitment and active participation.

Currently our schools have been provided a nationally acclaimed intervention program, selected by district headquarters’ personnel entitled “Ramp-up to Algebra 1”. According to the publisher, America’s Choice, it is “California’s Algebra Readiness Solution” (America's Choice, 2009). There exist some perceived limitations to this program: the absence of a diagnostic tool, inappropriate student placement, excessive material for one year (eight units combined to equal the size and weight of our biology textbooks), and the absence of some technology as part of the curriculum.

One barrier a diagnostic team would have is the lack of current data to support our interventions. The only data available is the 8th and 11th grade NECAP scores. In order to hone in on specific students and problem sets to establish an action plan, more recent data must be provided. This could be achieved by administering a school wide diagnostic test using the “Released Items 2008 Grade 8 NECAP (RIDE-NECAP, 2005).

Meticulous analysis of particular NECAP items is key to our focus. One approach to focus our resources is to identify specific and less sophisticated algebraic problems on the NECAP of which students overwhelmingly scored incorrectly. In this case, our study group identified questions 2, 11, 13, 18, and 21 on the NECAP, which serve as our central focus for our pre-algebraic intervention purposes. Grade Span Expectations represented through these identified focus items are ‘Data, Probability, and Statistics (DP) 10-1 and 10-2’, ‘Numbers and Operations 10-2 and 10-4 (NO)’, and ‘Functions and Algebra (FA) 10-4. These GSEs deals with a specific topic that allow us to expand on either side of the test question to develop pre-algebra curriculum. When our team analyzes the standard that corresponds to the NECAP questions we construct a lucid understanding of the type of question we might ask our students. Under other circumstances in the absence of a district wide pacing guide, our MIT would develop lesson plans and assessments central to our specific items inspired by NECAP results. The MIT would also, along with all departments/teams, be required to furnish curricular mapping units of instruction.

Before teams commence working on the central goal of closing the pre-algebraic gap, teams must establish trust and have a realistic sense of their current relational dynamics. A needs assessment to establish conditions for teamwork will be administered among other tools (Southern Regional Education Board, 2009, p. 22). I would have the MIT develop a formal team charter. This would provide collegial structures that would be used to ascertain and address MIT staff members' needs. The team charter would provide the necessary structured opportunities for the MIT to work together to design and implement activities like co-facilitation and teaming approaches, integrated design, new staff induction, and collaborative research. (Southern Regional Education Board, 2009) Given the reality of principal transience, this will solidify their purpose and self sustainment. Lastly, the team charter would be reviewed by sending out “Critical Issues for Team Consideration” questionnaire to periodically evaluate the effectiveness of the team charter. (DuFour, 2006, pp. 100-101)

Many of the instructional leadership team dispositions that warrant progress to school-wide practice can be facilitated through one basic task: effective communication. Specifically, I would use a free online software program called Google Docs Beta as a discussion board and survey tool, which is not blocked by PPSD (Google, Inc.). I would teach all members this quick, efficient, and data rich tool to gather ethnographic information from colleagues virtually instantly. Google Docs is replete with automatic graphs for quick analysis and showing. The SITs, PBGR team, the ninth grade team, and vertical content teams could communicate better with the MIT and vice versa through email, online discussion boards, and surveys in addition to agenda and meeting protocols already established. Through modeling first, I would require every teacher leader to utilize this online tool with other teachers in their department by having each faculty member answer specific questions via computer.

As principal and MIT director, I would use the “Checklist for Personal Values” list to help create or foster situations where divergent or conflicting needs emerge, treating them as opportunities to explore and reconcile deeply held values and assumptions. After soliciting feedback via online surveys or through a team activity known as Data on Display or the Spend Your Dots activity described in Golden and Gall’s team toolkit, I would demonstrate to the MIT that it can encourage and value staff members who represent perspectives different from those held by most, even if unpopular, by discussing what was included in the discussion boards (Nancy Golden; Joyce P. Gall, 2000, p. 146). Once again, this is an issue of effective and holistic communication being realized through Google Docs Beta. This tool would slow down and assist the math interventions team to ponder the implementation of initiatives and programs to allow multiple feedback loops.

I would require that the MIT agenda include the vision/mission statement and link goals to it. I would send out “Questions to Guide the Work of Your PLC” to the list serve, thereby all members would be ready to clarify the vision for our team and school, and reflect where we stand in September. (DuFour, 2006, pp. 40-42) At the end of our meetings, I would have all members of the ILT complete a “Reflections of the Day” electronic form so we could guide our MIT discussions and focus.

An electronic and physical book of everything related to the MIT’s business would be available to all faculty members to review with the goal of inviting the faculty in discussions during department meetings. Any programs, policies, and practices will be field tested, piloted, and then implemented large scale only after electronic discussion boards have been exhausted and multiple perspectives have weighed in on the initiative. As principal, I would engage the MIT in a trust and consensus building activity called “Called for a Power Sweep”, which can engages all ILT members in conversation about the degree to which goals and priorities are being addressed and implemented. This form of communications would use horizontal and vertical teams to uncover different perspectives and address questions about teaching, learning, and school improvement proposals. (Golden & Gall, 2000, p. 139)

I would collect the specific user friendly NECAP findings for analysis and set forth the major goal of eliminating deficiency of pre-algebraic skills. I would make this an ongoing agenda item throughout the year. In order for the MIT to focus on NECAP goals, first it needs to answer “Questions to Guide the Work” of the MIT. For example, “what evidence do we have that we use the results of common assessments to identify students who require additional time and support?” (DuFour, 2006, pp. 68-69) Currently the MIT facilitates the production of unit planning and assessment. However, common formative assessments need to be produced by the MIT and used as an immediate gauge for student intervention as early as three weeks. As leader I can guide the MIT to create SMART goals utilizing the format used in Learning by Doing (p129). Afterward, I would establish an online evaluation system that incorporates time for self-assessment and discussion of feedback from formative assessments before formal evaluation has begun. Periodic, informal, and formal conversations and other data (for example, observations, work samples, reflections) would enable the progress of the MIT to be tracked.

I would lead the math intervention team to broker different kinds of relationships to help everyone learn from others by organizing and using varied groupings by (role, responsibility, client, or interest). I also would verbally promote activities such as peer coaching and explore different ways of accessing members' expertise and work. Shared best practices workshops have paved the way at Hope to facilitate this for the ILT so why would it not work for our MIT. I would require that every member of the MIT facilitate a meeting. Each would prepare a PowerPoint or presentation tied in to the vision of making all students algebra ready.

Another alternative to the MIT and a remediation course offering during the traditional day schedule could be a 9th transition or remediation camps offered during a non-traditional schedule. Summers, weekends, and evenings could offer the more motivated students to achieve mastery of pre-algebraic concepts. These programs would include Volunteers in Providence and the local university students.

The research clearly indicates that in an era of high stakes testing, the professional learning community that houses an effective instructional leadership team is the most effective vessel for preparing all students for the world of work, the military, or college. The principal is no longer the indifferent administrator aloof to concerns of academic nature, but is the academic leader in chief responsible and accountable for ensuring pre-algebraic mastery and academic rigor. We found that there are several steps our school can take to ensure pre-algebraic mastery and academic press with the goal of preparing our students for the world of college and/or work in the twenty first century. Tracking has been detrimental, while ability grouping is a logical step in our era. All students must be allowed to take a placement test or test out of the course and receive credit. Students must be afforded academically challenging courses in addition to basic math revamp courses, such as advanced algebra. Guidance counselors and teachers must use this objective and subjective data to encourage students’ placement in college or career-preparatory classes that challenge students to their fullest potential. If these measures are not taken, an effort to ensure pre-algebraic mastery and academic press will be substituted for academic busyness and pressure to just move students along. This would not prepare students for state tests, the world of college or career given the current economic challenges we are facing in the 21st century, scilicet, the Great Recession.

NEXT FOCUS ITEMS FOR PAPER

1. LOOK AT SPECIFIC PROBLEM SETS
2. USE TAXOMONY TABLE TO IDENTIFY PROBLEMS WITH ALIGNMENT OF STANDARDS, GSE/GLE, AND OBJECTIVES (MY TEAM WILL WORK TOGETHER)
3. PROVIDE SPECIFIC LESSONS THAT CAN BE USED
4. FOCUS ON SMART GOALS–specific, measurable, attainable, results oriented and time-bound GOALS

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